Automated Pulsar Receiver

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This article describes a self-contained computer-controlled 30-MHz-to-baseband receiver. This receiver has three selectable predetection bandwidths, a diode power detector, an internal level set, and 15 postdetection bandwidths. It is designed to directly interface with an on-site data reduction system. Its primary utilization is the automatic monitoring of pulsar signals.

I. Introduction

A requirement to support the R&D pulsar experiment without placing additional burdens on the DSS 13 operating personnel has resulted in the development of a computer-controlled receiver.

II. Implementation

The pulsar receiver (Figs. 1–3) is a completely self-contained 30-MHz-to-baseband system. The 30-MHz input signal (Fig. 4) is amplified by 20 dB before being applied to a step attenuator; the step attenuator allows the experimenter to maintain a constant (within 0.5 dB) noise power, thus preventing signal distortion due to noise overloading. The 30-MHz signal is then shaped with one of three possible predetection bandpass filters. This shaped 30-MHz signal goes to the final RF amplifier, and the output of this amplifier is converted to baseband frequencies by a wideband diode detector operating in the square law range. The detected signal is then amplified 100 times and shaped by one of a possible 15 postdetection filters. This signal is then transmitted to the DSS 13 data system.

The unique feature of this receiver is that all functions, predetection bandwidth, gain, and postdetection bandwidth, are controlled by the computer, therefore allowing the experimenter to have complete control of his receiver through the software generated for the individual task. Figures 5 and 6 show the results of two final measurements made to determine receiver performance. These curves are typical and the pulsar receiver achieved all engineering design requirements.

III. Conclusion

This pulsar receiver has been interfaced with the planetary radar receiver and the on-site data system at DSS 13. It is presently supporting the pulsar experiment in a manual mode, and after the software program now under development is complete, no further development has been planned.

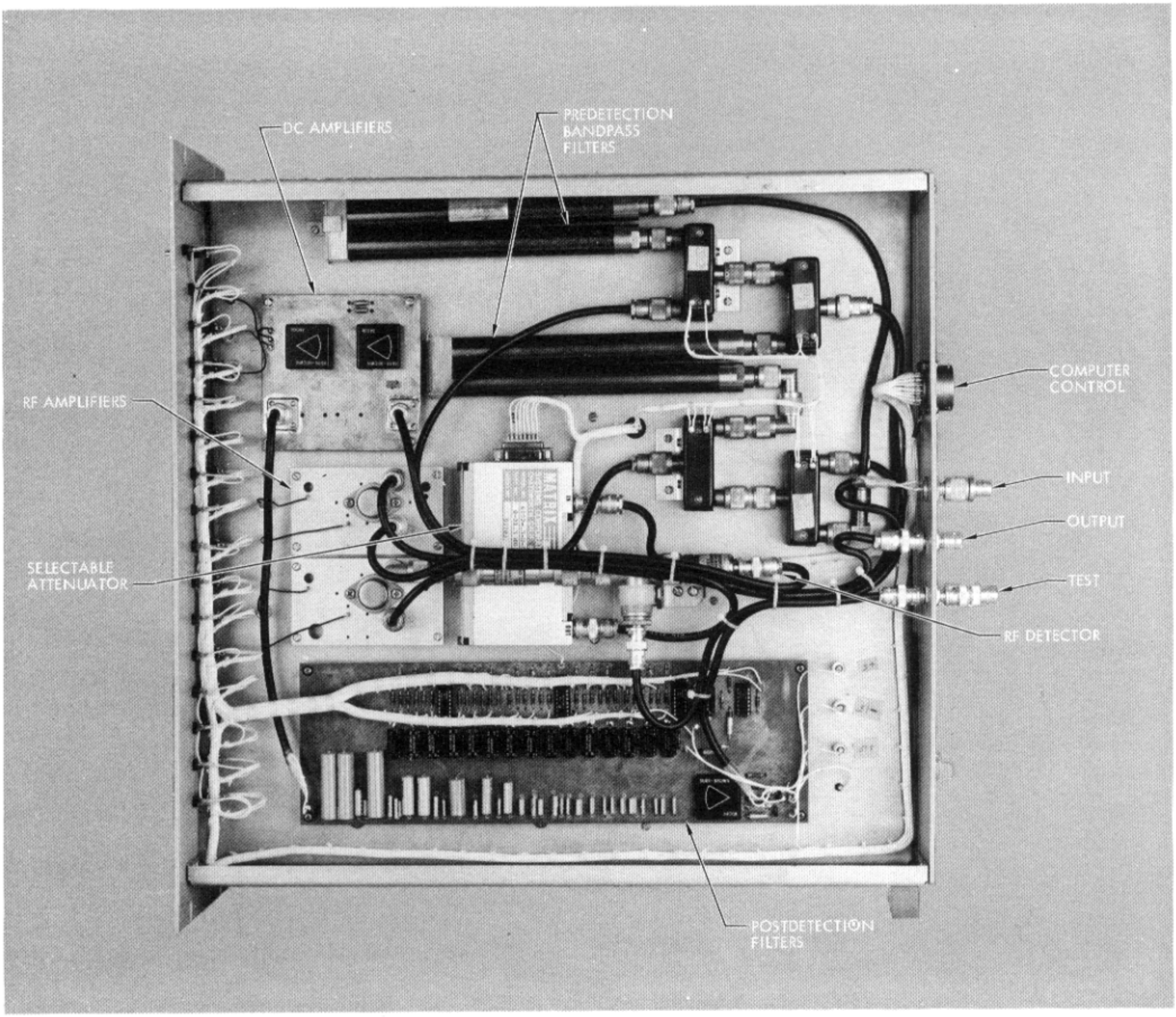

Fig. 1. Pulsar receiver, top view

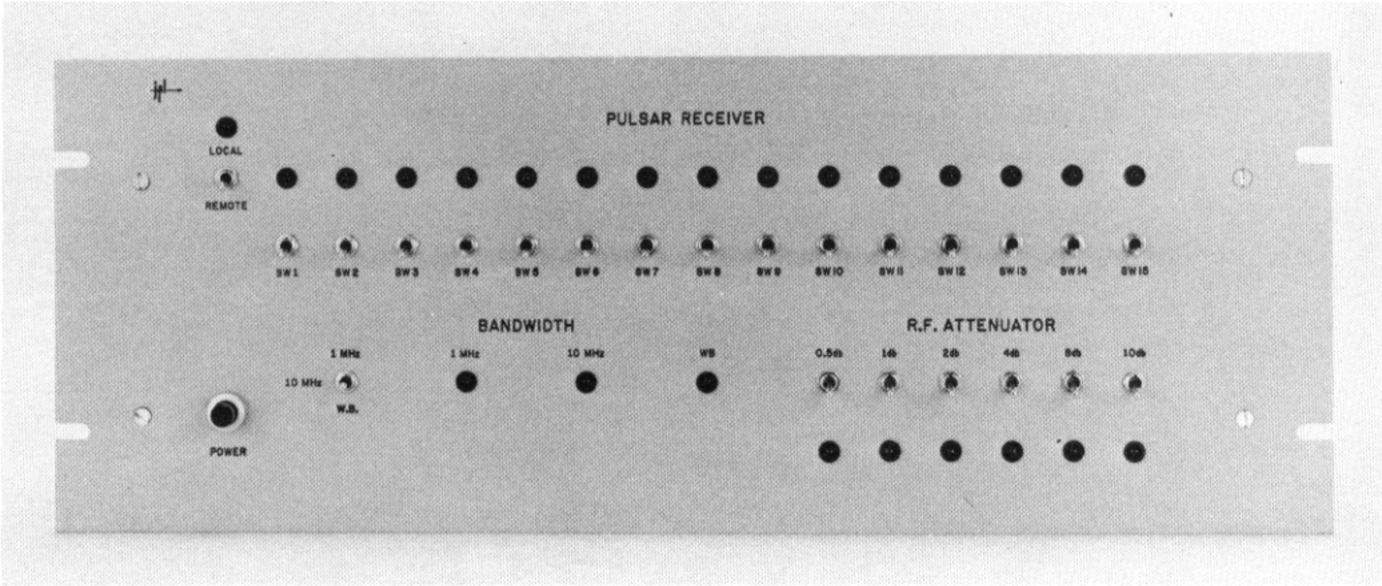

Fig. 2. Pulsar receiver, front view

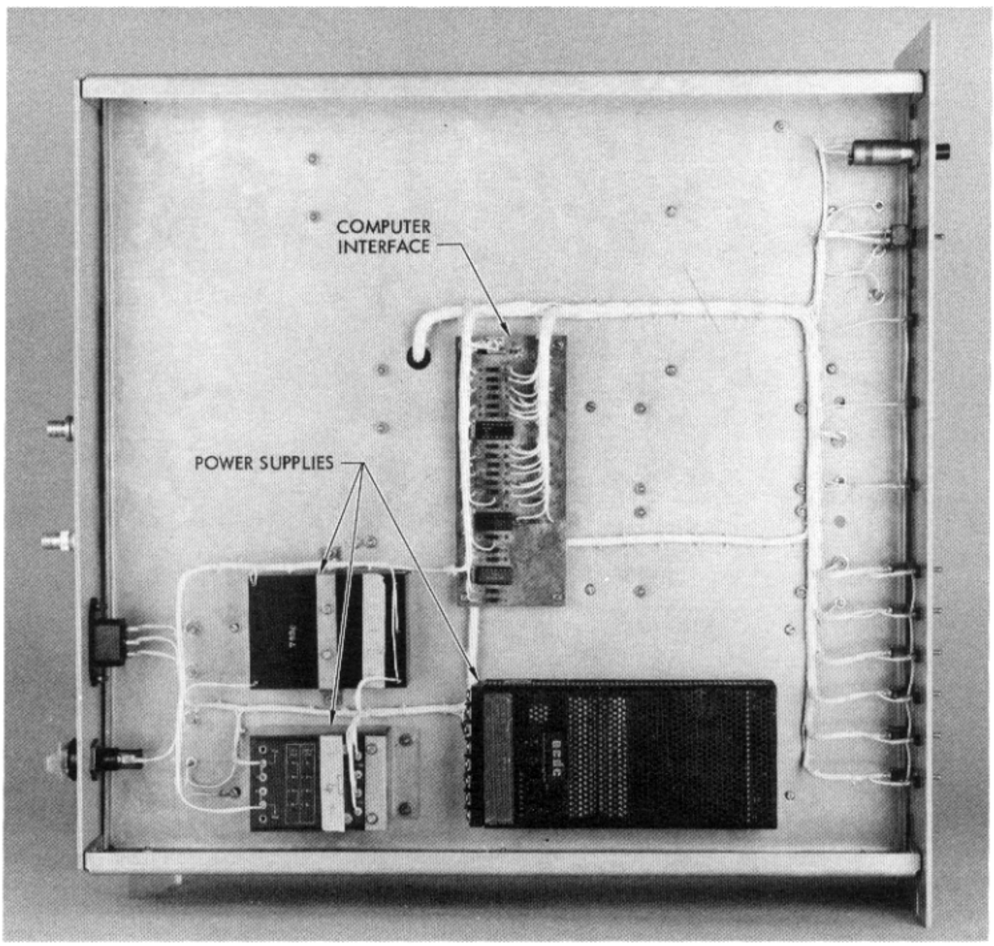

Fig. 3. Pulsar receiver, bottom view

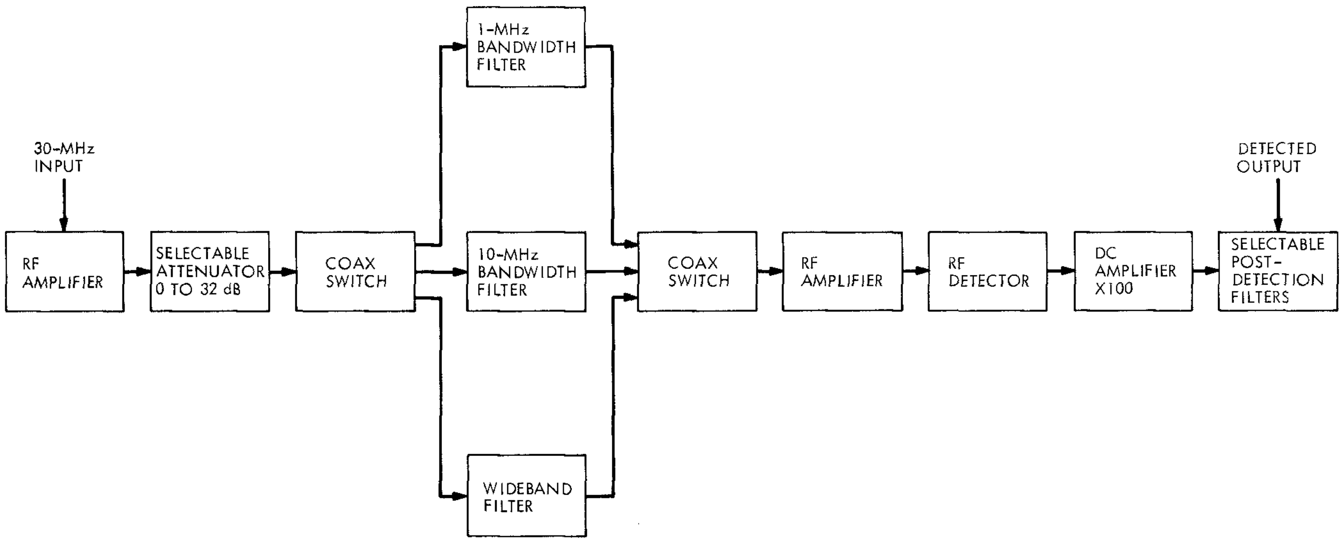

Fig. 4. Pulsar receiver block diagram

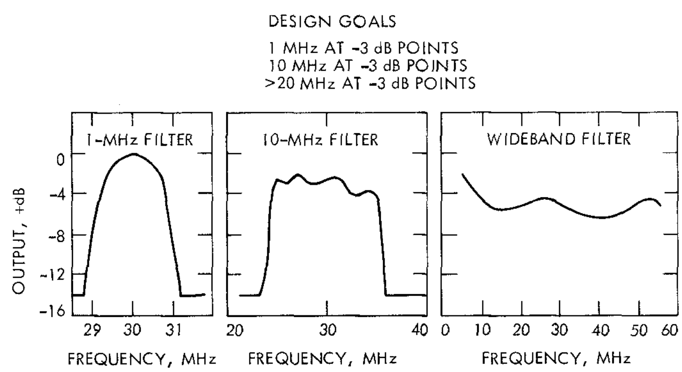

Fig. 5. Predetection bandpass filters

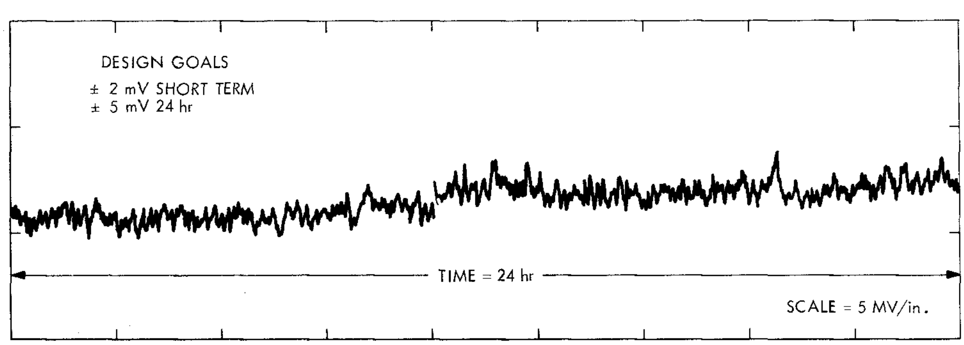

Fig. 6. DC stability pulsar receiver